HIGH-VOLTAGE DISCHARGE IN SUPersonic JET OF PLUMBUM VAPOR

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During the investigation of vacuum discharge in plumbum evaporating from molybdenum crucible in identical geometry of discharge gap and the same crucible temperature existence of two different discharge forms were observed. These two forms are vacuum arc with current more than 10 A and discharge voltage about 15 V and high-voltage discharge with current of about 10 mA and voltage of 350 V.

Experiments were carried on vacuum chamber with residual pressure less than 10 mPa. Plumbum was placed in heat-isolated crucible (cathode) with internal diameter 19 mm, closed by cover with hole diameter 6 mm. Electron-beam heater was situated under the crucible. This heater could change the crucible temperature at the fixed current of arc. The water-cooled steel disc with central hole 15 mm in diameter was used as the anode.

At the temperature 1.25 kK which corresponds to plumbum saturated vapor pressure about 0.1 kPa voltage from power source (380 V, 200 A) was applied to anode and high-voltage discharge initiated with characteristics mentioned above. After a few seconds this discharge could turn into arc, or could exist hundreds of seconds until full plumbum evaporation. Crucible temperature increase until 1.4 kK accompanied by rising of plasma radiation intensity but under these conditions high-voltage discharge didn’t switch to arc regime. At the temperature of 1.15 kK the discharge spontaneously disappeared. At more high temperatures discharge may also spontaneously fade but then it ignites again.

The pictures of discharge glow are described. They could take the form of a cone, harness, or plasma bunch, which is at the appreciable distance from the electrodes. The estimations of plasma parameters are presented.

The study was supported by grant from the Russian Scientific Fund (project #14-29-00231).